

In a communication system, channel operating parameter carrier frequencies are located in the vicinity of data nulls in a data spectrum. The operating parameter carriers are summed with the data signal. At the receiver, the operating parameter carrier frequencies are recovered by demodulation techniques, and the operating parameters are recovered and processed.

## File: OCOPFNT2W Data output

### Time Stamp

Year= 2001, Month= 3, Day= 15, Time (EST) = 20:1:59.2 ;

Computation Time (sec)=0 ;

\*\*\*\*\* Repeaters have been found with an accuracy of 1 Bit(s) or 0.2 Km \*\*\*\*\*

Word length (Bits)= 32.0; Run Number = 1.0; Peak Value (Sum of Bits) = 17.04

Distance; Relative to 1st;		Inter-Repeater Span	
Km;	Km;	Km;	Bits; log2(Bits)
6.00;	0.00;	0.00;	30.0; 4.91
6.20;	0.20;	0.20;	31.0; 4.95
6.40;	0.40;	0.20;	32.0; 5.00
25.20;	19.20;	18.80;	126.0; 6.98
25.40;	19.40;	0.20;	127.0; 6.99
25.60;	19.60;	0.20;	128.0; 7.00
44.40;	38.40;	18.80;	222.0; 7.79
44.60;	38.60;	0.20;	223.0; 7.80
44.80;	38.80;	0.20;	224.0; 7.81
63.60;	57.60;	18.80;	318.0; 8.31
63.80;	57.80;	0.20;	319.0; 8.32
64.00;	58.00;	0.20;	320.0; 8.32

### Time Stamp

Year= 2001, Month= 3, Day= 15, Time (EST) = 20:2:4.97 ;

Computation Time (sec)=0 ;

\*\*\*\*\* Repeaters have been found with an accuracy of 1 Bit(s) or 0.2 Km \*\*\*\*\*

Word length (Bits)= 32.0; Run Number = 2.0; Peak Value (Sum of Bits) = 43.09

Distance; Relative to 1st;		Inter-Repeater Span	
Km;	Km;	Km;	Bits; log2(Bits)
23.40;	0.00;	0.00;	117.0; 6.87
23.60;	0.20;	0.20;	118.0; 6.88
23.80;	0.40;	0.20;	119.0; 6.89
24.00;	0.60;	0.20;	120.0; 6.91
24.20;	0.80;	0.20;	121.0; 6.92
24.40;	1.00;	0.20;	122.0; 6.93
24.60;	1.20;	0.20;	123.0; 6.94
24.80;	1.40;	0.20;	124.0; 6.95
25.60;	2.20;	0.80;	128.0; 7.00
64.00;	40.60;	38.40;	320.0; 8.32

Time Stamp

Year= 2001, Month= 3, Day= 15, Time (EST) = 20:2:8.32 ;

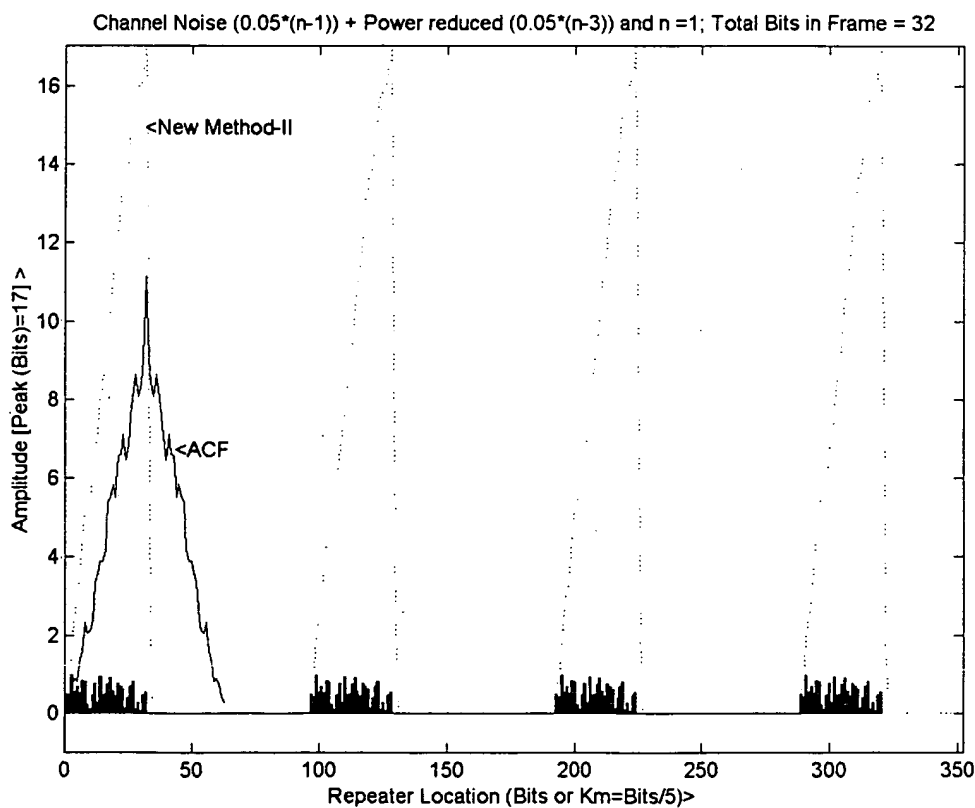
Computation Time (sec)=0 ;

\*\*\*\*\* Repeaters have been found with an accuracy of 1 Bit(s) or 0.2 Km \*\*\*\*\*

Word length (Bits)= 32.0; Run Number = 3.0; Peak Value (Sum of Bits) = 54.51

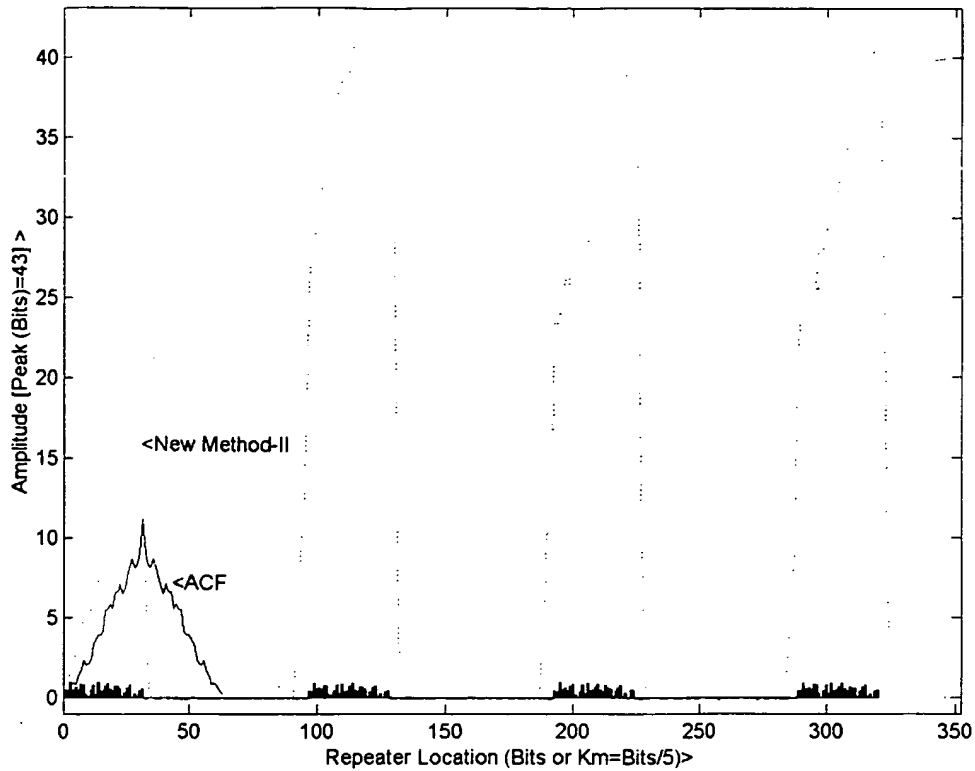
Distance; Relative to 1st;		Inter-Repeater Span	
Km;	Km;	Km;	Bits; log2(Bits)
43.80;	0.00;	0.00;	219.0; 7.77
44.00;	0.20;	0.20;	220.0; 7.78
44.60;	0.80;	0.60;	223.0; 7.80

### OCOPFNT2W Graphs

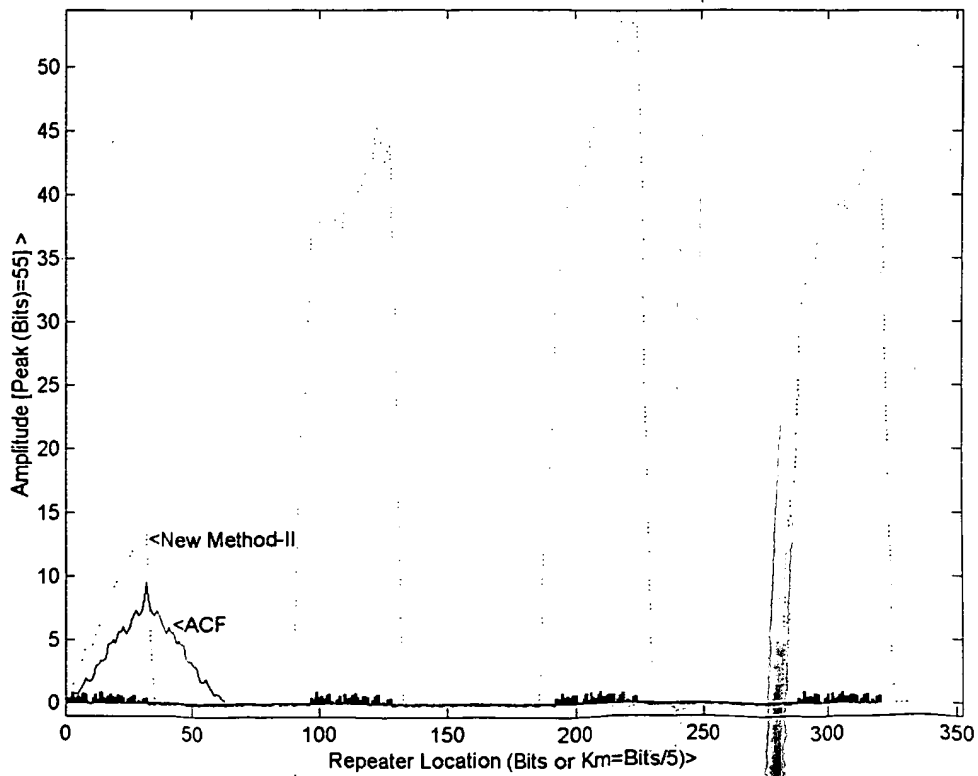


102020-8482000

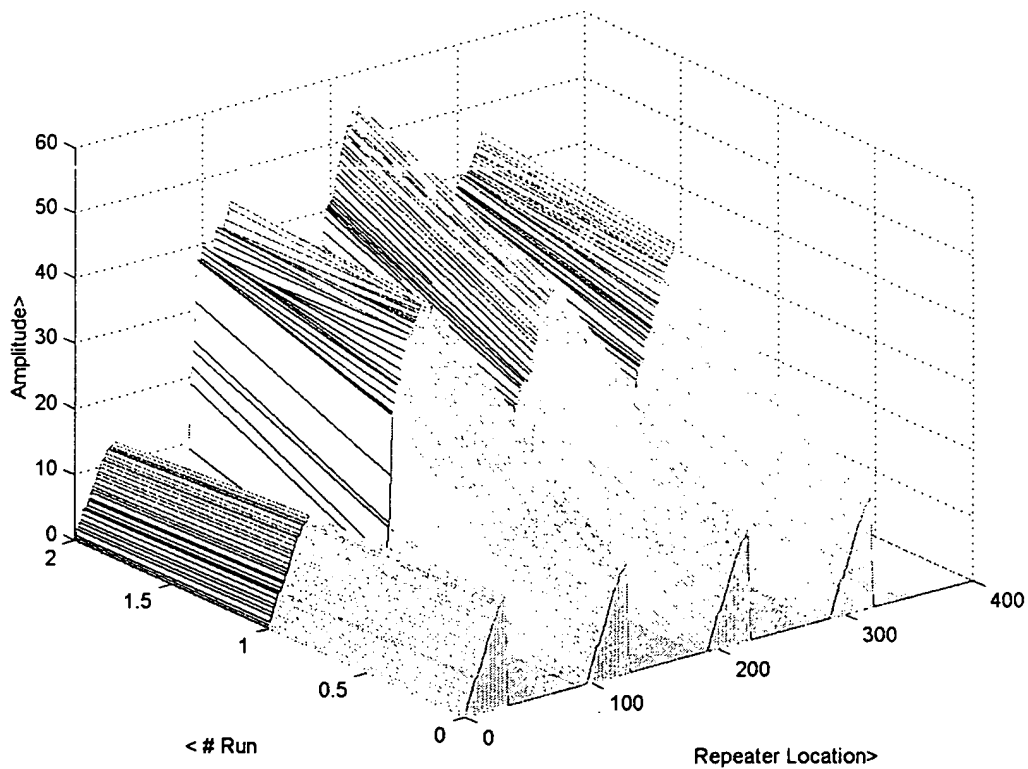
Channel Noise  $(0.05 \cdot (n-1))$  + Power reduced  $(0.05 \cdot (n-3))$  and  $n=2$ ; Total Bits in Frame = 32



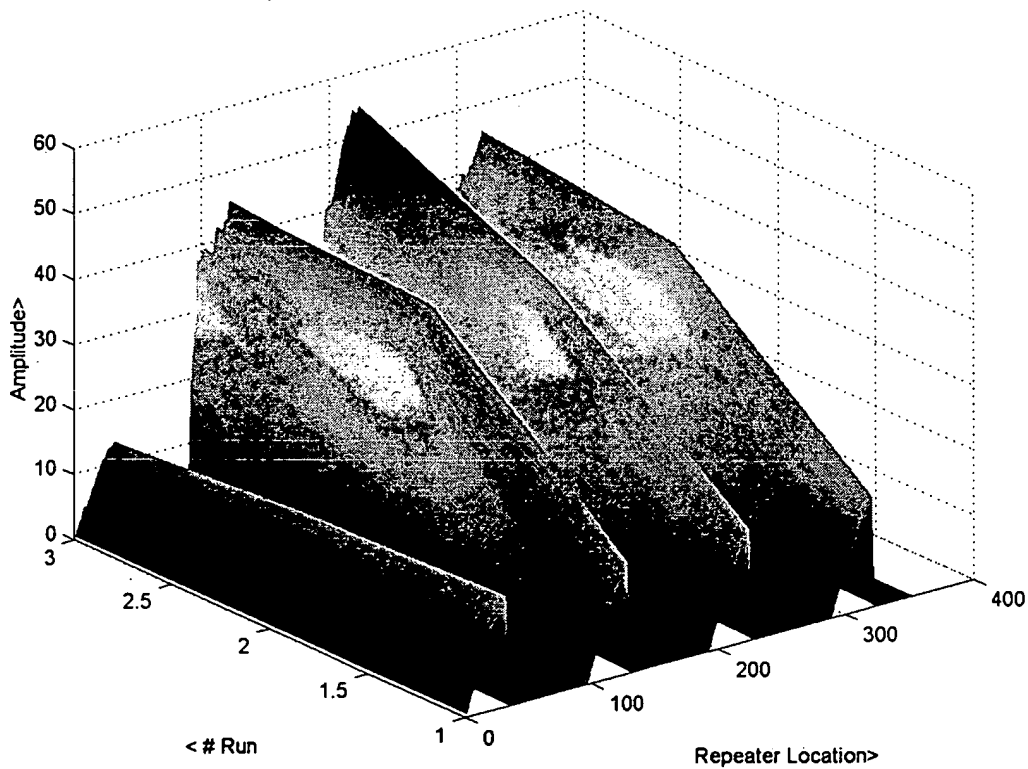
Channel Noise  $(0.05 \cdot (n-1))$  + Power reduced  $(0.05 \cdot (n-3))$  and  $n=3$ ; Total Bits in Frame = 32



OCOP Repeater Location, NOISE= none; Bits in Frame =32; Test Run= 3



OCOP Repeater Location, NOISE= none; Bits in Frame =32; Test Run= 3



## MATLAB CODES

diary OCOPfnt2w.doc

% filename OCOPfnt2w

% compare ACF & New Technique-I for frame of 32,128 bits, with three runs for each

%fixed random bit patterns (PBRs)

% number of repeaters = 6

% channel noise in 2 and 3rd run, power reduction in 3rd run

% requires double spacing between repeaters or less number of pulses in a Frame

% sensitive to channel noise, filter implementation artifacts

```
clg; clear;
```

```
ba=1;
```

```
out=[];
```

for  $wl=32:96:100$ ,

```
s=rand(wl,1);
```

% number of columns in the convolution matrix = wl+1

% equal to number of bits per frame= LME-Tx PN1

```
truns=3;      % total runs for a given wordlength (wl);
```

```
for n=1:truns, % simulate four different measurement tuns
```

% nsx =no signal for lme receiver=the number of

% zeroes are propotional to distance between

% any two repeaters, set to vary with wl(easy)

```
tic;
```

```
%s=rand(wl,1);
```

```
% generate different PRBS for each run
```

```
ns1=zeros(wl,1);ns2=zeros(2*wl,1);ns3=zeros(3*wl,1);
```

```
ns4=zeros(wl*4,1);ns5=zeros(5*wl,1);ns6=zeros(wl,1);
```

if  $n > 2$ ,

```
pd=0.025*n; sn=s-s.*pd;
```

```
else sn=s; ;pd=0;
```

end;

```
z=[sn;ns2;s;ns2;s;ns2;s];%s;ns4;s;ns5;s;ns6]; % lme Tx data
```

% channel noise

if  $n > 1$ ,

```
cn=0.05*n;z=z-cn.*rand(length(z),1);
```

```
else noise=zeros(length(z)); cn=0;
```

end;

% The number of zeroes at the end of rinput (=z)= m= number of

% information bit in rin as transmitted from LME and received

% from individual repeaters at the LME receiver input

```
repeater=convmtx(z,wl+1); % generate padded columns
```

```
% initialize for multiple runs
```

```
out1=0; % initialize for single run
```

% for New Technique-I remove % below

[illegible]

```

        for j=1:wl+1, out1=out1+repeater(:,j); end;

    padl=zeros(wl,1);
    outpaded=[padl;out1];% Shifted, negative outnc vector
    outneg=outpaded(1:length(out1),:);
    %outf=out1-outneg.*(max(out1)/10);
    outf=out1-outneg.*(max(out1)-1);
                                % filter for DUMP after Peak
    for i=1:length(outf)
        if outf(i) <= 0
            out1(i)=0;
        else out1(i)=outf(i);
        end
    end,

    out=[out,out1];                                % for 3-D plot

    peak=max(out1);                                % search for maxima in current out1
    m=find(out1 > peak-ba); [m m./5]; % get remaining peaks within, peak-ba
    km=m./5;                                        % Kilometer = No. of Bits*1 micro-sec/bit*1/5
microsec per km
    Rfirst=km-km(1); IRS=0;                        % Repeaters location relative first repeater
    for q=1:length(km)-1,                          % compute Inter-Repeater span
        IRS1=km(q+1)-km(q); IRS=[IRS;IRS1];end

    lmeout=[km Rfirst IRS m log2(m)];

    fprintf(1,'Time Stamp\n');
    fprintf(1,'Year= %g, Month= %g, Day= %g, Time (EST) = %g:%g:%g ; \n Computation
Time (sec)=%g ;\n',clock,toc)
    fprintf('***** Repeaters have been found with an accuracy of %g Bit(s) or %g Km
*****\n',ba, ba/5)
    fprintf(1,'Word length (Bits)= %5.1f; Run Number = %6.1f; Peak Value (Sum of Bits)
=%6.2f \n',wl,n,peak)
    fprintf('\n
\n')
    fprintf(1,'%12s;%17s;%24s\n','Distance','Relative to 1st','Inter-Repeater Span')
    fprintf(1,'%9s;%12s;%19s;%18s;%12s\n','Km','Km','Km','Bits','log2(Bits)')
    fprintf('-----\n')
    fprintf(1,'%9.2f;%12.2f;%19.2f;%18.1f;%8.2f\n',lmeout)

    plot(out1,'g:'), axis([0 length(out1) -1 max(out1)]), axis(axis); hold on,
    title(['Channel Noise (0.05*(n-1)) + Power reduced (0.05*(n-3)) and n =',int2str(n),';
Total Bits in Frame = ',int2str(wl)]),
    xlabel('Repeater Location (Bits or Km=Bits/5)>'),

```

